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Indian Standard

METHODS OF TEST AND QUALITY REQUIREMENTS FOR PORCELAIN LABORATORY APPARATUS

(First Revision)

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METHODS OF TEST AND QUALITY REQUIREMENTS FOR PORCELAIN LABORATORY APPARATUS

(First Revision)

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Indian Standard

METHODS OF TEST AND QUALITY REQUIREMENTS FOR PORCELAIN LABORATORY APPARATUS

(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 20 September 1974, after the draft finalized by the Ceramicware Sectional Committee had been approved by the Chemical Division Council.

0.2 This standard was first published in 1964, under the title 'Methods of test for laboratory porcelain'. In this revision, to make the standard more comprehensive, quality requirements of porcelain laboratory apparatus have also been incorporated as in ISO/R 1775-1970 'Porcelain laboratory apparatus — quality and methods of test' issued by the International Organization for Standardization (ISO). Further, test for resistance to heat and sudden change of temperature which was earlier prescribed separately for porcelain crucibles and basins has now been merged into one as it is felt that the test could, for convenience, be done on one of the articles mentioned; the results being accepted as generally applicable to all articles made under similar conditions from the same batch of material.

0.3 In reporting the result of a test made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2-1960*.

1. SCOPE

1.1 This standard prescribes the methods of test and quality requirements for porcelain laboratory apparatus, including microchemical apparatus.

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*Rules for rounding off numerical values (*revised*).

1.1.1 The methods of test and quality requirements have been prescribed in respect of:

a) porosity of body and imperfections of glaze,
b) resistance to heat and sudden change of temperature,
c) resistance of glaze to high temperature,
d) constancy of mass on heating, and
e) resistance of glaze to acid and alkali.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions given in IS:2781-1964* shall apply.

3. SAMPLING

3.1 Representative samples of porcelain laboratory apparatus shall be drawn as specified in the relevant material specifications.

4. QUALITY REQUIREMENTS

4.1 Porosity of Body — There shall not be any staining of the porcelain and/or creeping of the eosin solution (*see* **5.1**, **5.1.4.1** and **5.1.4.2**).

4.2 Imperfections of Glaze — Porcelain shall not show any crazing or other defects (*see* **5.1** and **5.1.4.3**).

4.3 Resistance to Heat and Sudden Change of Temperature — The crucible(s) when heated to a temperature 230°C above the ambient temperature and quenched in water maintained at room temperature, shall not break, crack or show crazing as defined in **5.2**.

4.4 Resistance of Glaze to High Temperature — Glaze on the complete article(s) or broken pieces shall not show softening as defined in **5.3**.

4.5 Resistance of Glaze to Acid and Alkali — Porcelain when tested as prescribed in **5.4**, shall not show losses in mass greater than the following:

a) *Hydrochloric Acid Test* — 0·01 mg/cm^2 of the total inner surface of the vessel;
b) *Sodium Carbonate Test* — 0·1 mg/cm^2 of the surface covered by the liquid; and
c) *Sodium Hydroxide Test* — 0·6 mg/cm^2 of the surface covered by the liquid.

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*Glossary of terms relating to ceramicware.

4.6 Constancy of Mass on Heating — Porcelain shall not vary in mass by more than 0·1 mg per 10 g of its total mass.

5. METHODS OF TEST

5.1 Porosity of Body and Imperfections of Glaze

5.1.1 *Material for Test* — clearly broken pieces from test samples. The two major surfaces shall be glazed and any other surfaces shall be unglazed and freshly broken. Care shall be taken not to produce cracks in the body or in the glaze; any such pieces shall be discarded.

5.1.2 *Reagent* — solution of eosin, prepared by dissolving 5 g in 1 litre of distilled water (*see* IS : 1070-1960*).

5.1.3 *Test Procedure* — Completely immerse the broken pieces of porcelain in the eosin solution and allow them to soak at room temperature for 18 hours. Rinse the pieces thoroughly with water, dry with a cloth and examine them with a hand lens.

5.1.4 *Interpretation of Results*

5.1.4.1 *Porosity* — Porcelain showing general staining of unglazed portions, indicating penetration of the eosin solution through the body, shall be reported as failing the test.

NOTE — The test sample may be broken to see that no dye penetration has taken place.

5.1.4.2 Porcelain showing a creeping effect of the eosin solution between the glaze and the body, indicating lack of adhesion between them, shall be reported as failing the test.

5.1.4.3 *Imperfection of glaze* — Porcelain showing spots of staining with a shading or fringe around them shall be reported as failing the test.

5.2 Resistance to Heat and Sudden Change of Temperature

5.2.1 *Material for Test* — complete crucible(s) not exceeding 46 mm in diameter.

5.2.2 *Apparatus* — A suitable apparatus is illustrated in Fig. 1 and consists of the parts given in **5.2.2.1** to **5.2.2.3**.

5.2.2.1 *Furnace* — consisting of a vertical tube, of about 100 mm internal diameter and 500 mm in length, provided with a short side tube half way down to take a thermometer. It is uniformly wound with resistance wire to consume about 1 kW of power and is efficiently lagged and fitted with suitable means of controlling the temperature.

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*Specification for water, distilled quality (*revised*).

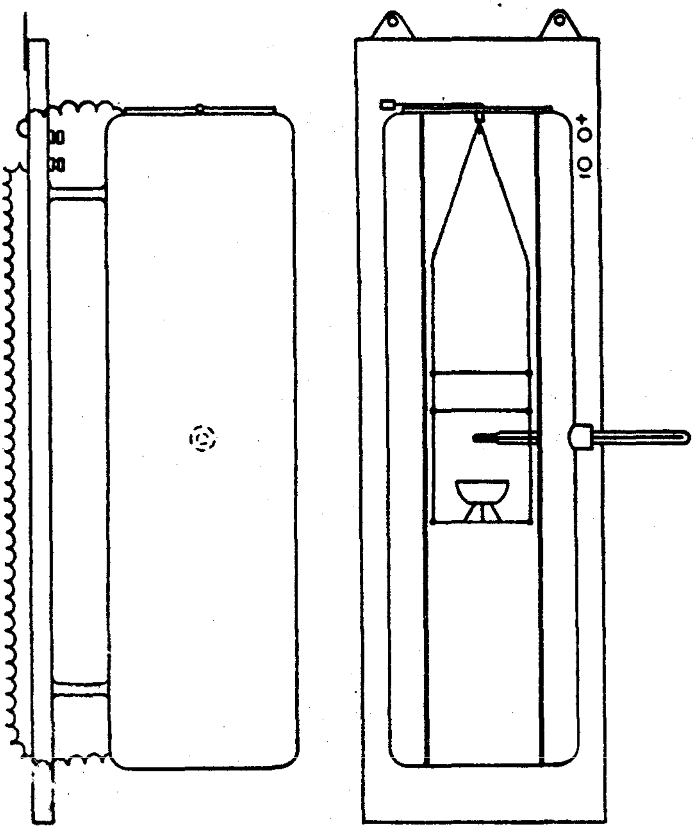

FIG. 1 SUITABLE APPARATUS FOR TEST FOR RESISTANCE TO HEAT AND SUDDEN CHANGE OF TEMPERATURE

5.2.2.2 *Wire cage* — for holding the crucible. It shall be suspended from the lid of the furnace in such a way as to fall freely when desired.

5.2.2.3 *Thermometer* — having a range from 0°C to 300°C (*see* Schedule Mark 16 of IS : 2480-1973*).

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*Specification for solid-stem general purpose glass thermometers (*first revision*).

5.2.3 *Test Procedure* — Place the crucible bottom downwards in the cage and heat for fifteen minutes at a temperature of 230°C above the room temperature. Remove the thermometer and allow the cage and crucible to fall into a bucket of water at room temperature, the surface of water being about 150 mm below the bottom of the furnace. Examine the crucible and if not broken or cracked dip into 5 g/l eosin solution (*see* **5.1.2**).

5.2.4 *Interpretation of Results* — A crucible which is fractured or which shows staining, indicating damage to the glaze, shall be reported as failing the test.

5.3 Resistance of Glaze to High Temperature

5.3.1 *Material for Test* — complete articles or broken pieces.

5.3.2 *Test Procedure* — Place some small clean broken pieces of the porcelain in a crucible or dish of the same make in such a way that the glazed surfaces are in contact as far as possible. Heat the porcelain for 2 hours in a muffle furnace at a temperature of 900°C, allow to cool and examine the pieces for adhesion to each other or to the containing vessel.

5.3.3 *Interpretation of Results* — Porcelain showing adhesion shall be reported as failing the test.

5.4 Resistance of Glaze to Acid and Alkali

5.4.0 *General* — The three tests prescribed in **5.4.4.1**, **5.4.4.2** and **5.4.4.3** shall be carried out on 3 individual articles or vessels; no single item shall be subjected to more than one test.

5.4.1 *Material for Test* — complete article (vessel).

5.4.2 *Reagents*

5.4.2.1 *Hydrochloric acid* — constant boiling point. Dilute 600 ml of hydrochloric acid (*see* IS : 265-1962*) to 1 000 ml with distilled water (*see* IS : 1070-1960†).

5.4.2.2 *Sodium carbonate solution* — 50 g/l. Dissolve 50 g of sodium carbonate (*see* IS : 296-1965‡) in distilled water and dilute to 1 litre.

5.4.2.3 *Sodium hydroxide solution* — 50 g/l. Dissolve 50 g of sodium hydroxide (*see* IS : 376-1969§) in distilled water and dilute to 1 litre.

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*Specification for hydrochloric acid (*revised*).

†Specification for water, distilled quality (*revised*).

‡Specification for sodium carbonate, anhydrous (*revised*).

§Specification for sodium hydroxide, analytical reagent (*first revision*).

5.4.3 *Preparation of Test Specimen* — Wash the porcelain vessel in cold 1 N hydrochloric acid followed by distilled water, heat to constant mass at 120°C and when cold, tare it against a similar vessel.

5.4.4 *Test Procedure*

5.4.4.1 *Hydrochloric acid test* — Fill the vessel to three-quarters of its total capacity with constant boiling point hydrochloric acid (*see* **5.4.2.1**), cover it with a clock glass and heat on a steam bath for 4 hours. Wash the vessel with distilled water and dry to a constant mass at 120°C, taring against the same vessel as before.

5.4.4.2 *Sodium carbonate test* — Test as in **5.4.4.1** but using sodium carbonate solution (*see* **5.4.2.2**). After heating wash the vessel with 1 N hydrochloric acid followed by distilled water before drying.

5.4.4.3 *Sodium hydroxide test* — Test as in **5.4.4.1**, but using sodium hydroxide solution (*see* **5.4.2.3**).

NOTE — In the tests described in **5.4.4.2** and **5.4.4.3**, the volume of solution shall be measured before and after heating and the result of the test shall be ignored if the change in volume exceeds 10 percent.

5.4.5 *Reporting of Results* — Calculate the loss in mass of the vessel in milligrams per square centimetre of the total inner surface of the vessel (for hydrochloric acid test) or in milligrams per square centimetre of the surface of the vessel covered by the test liquid (for sodium carbonate and sodium hydroxide tests).

5.5 Constancy of Mass on Heating

5.5.1 *Material for Test* — complete articles or broken pieces.

5.5.2 *Test Procedure* — Wash the articles or test pieces in cold 1 N hydrochloric acid followed by distilled water (*see* IS : 1070-1960*), then dry and heat to about 650°C. Allow to cool, and weigh and repeat the heating until constant mass is obtained. Then heat them for 2 hours in a muffle furnace at a temperature of 950°C to 1 000°C, allow to cool in a desiccator and weigh again.

5.5.3 *Reporting of Results* — Report any change in the mass of the article(s) or broken pieces in milligrams per 10 g of total mass.

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*Specification for water, distilled quality (*revised*).

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

Quantity	*Unit*	*Symbol*
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

Quantity	*Unit*	*Symbol*
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

Quantity	*Unit*	*Symbol*	*Conversion*
Force	newton	N	1 N = 1 kg.1 m/s^2
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
Electric conductance	siemens	S	1 S = 1 A/V
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2

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